Office of
Fissile Materials Disposition

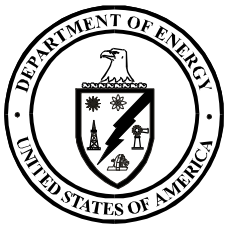
United States Department of Energy

Surplus Plutonium Disposition Final Environmental Impact Statement

Summary

November 1999

For Further Information Contact:
U.S. Department of Energy
Office of Fissile Materials Disposition, P.O. Box 23786, Washington, DC 20026-3786



DOE/EIS-0283

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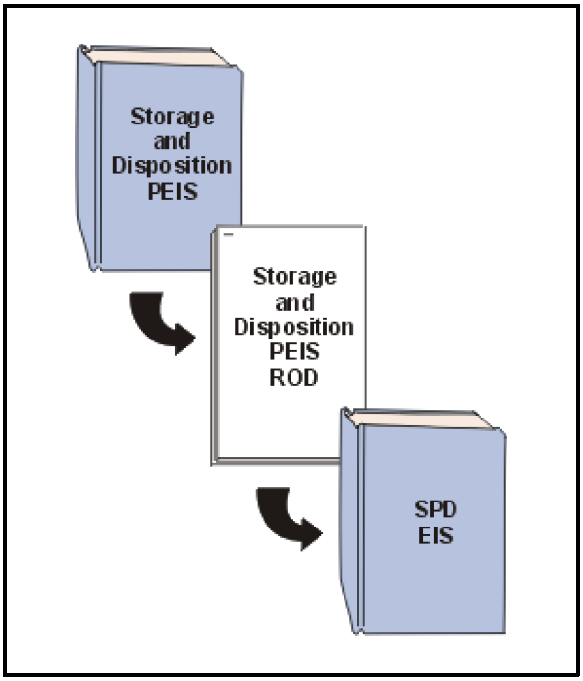
Summary

S.1 INTRODUCTION

In December 1996, the U.S. Department of Energy (DOE) published the *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement* (*Storage and Disposition PEIS*) (DOE 1996a). That PEIS analyzes the potential environmental consequences of alternative strategies for the long-term storage of weapons-usable plutonium and highly enriched uranium (HEU) and the disposition of weapons-usable plutonium that has been or may be declared surplus to national security needs.[1] The Record of Decision (ROD) for the *Storage and Disposition PEIS*, issued on January 14, 1997 (DOE 1997a), outlines DOE's decision to pursue an approach to plutonium disposition that would make surplus weapons-usable plutonium inaccessible and unattractive for weapons use. DOE's disposition strategy, consistent with the Preferred Alternative analyzed in the *Storage and Disposition PEIS*, allows for both the immobilization of some (and potentially all) of the surplus plutonium and use of some of the surplus plutonium as mixed oxide (MOX) fuel in existing domestic, commercial reactors. The disposition of surplus plutonium would also involve disposal of both the immobilized plutonium and the MOX fuel (as spent nuclear fuel) in a potential geologic repository.[2,3]

On May 22, 1997, DOE published a Notice of Intent (NOI) in the Federal Register (FR) (DOE 1997b) announcing its decision to prepare an environmental impact statement (EIS) that would tier from the analysis and decisions reached in connection with the *Storage and Disposition PEIS*. This EIS, the *Surplus Plutonium Disposition Environmental Impact Statement* (SPD EIS), addresses the extent to which each of the two plutonium disposition approaches (immobilization and MOX) would be implemented and analyzes candidate sites for plutonium disposition facilities and activities (i.e., lead assembly fabrication and postirradiation examination),[4] as well as alternative technologies for immobilization. In July 1998, DOE issued the SPD Draft EIS. That draft included a description of the potential environmental impacts of using from three to eight commercial nuclear reactors to irradiate MOX fuel. The potential impacts were based on a generic reactor analysis. In March 1999, DOE awarded a contract for



[1] DOE addresses the disposition of surplus HEU in a separate environmental impact statement, the *Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement* (DOE 1996b) issued in June 1996, with the ROD (DOE 1996c) issued in August 1996.

[2] The U.S. Nuclear Regulatory Commission (NRC) has reviewed DOE's plans to place immobilized material into the potential geologic repository and has agreed that with adequate canister and package design features, the immobilized plutonium waste forms can be acceptable for disposal in the repository (Paperiello 1999).

[3] Sidebars are used throughout the Summary of the SPD Final EIS to indicate where changes were made since the Summary of the SPD Draft EIS and the *Supplement* were issued. Section S.2 discusses these changes.

[4] The SPD EIS also analyzes a No Action Alternative, i.e., the possibility of disposition not occurring and, instead, continued storage of surplus plutonium in accordance with the *Storage and Disposition PEIS* ROD.

MOX fuel fabrication and irradiation services.[5] After this award, DOE issued a *Supplement to the SPD Draft EIS (Supplement)* (April 1999) that describes the potential environmental impacts of using MOX fuel at three proposed reactor sites and provides updated information on the proposed disposition program. These updates and site-specific analyses have been incorporated in the SPD Final EIS.

The SPD EIS analyzes a nominal 50 metric tons (t) (55 tons) of surplus weapons-usable plutonium, which is primarily in the form of pits (the core element of a nuclear weapon's fission component), metals, and oxides.[6] In addition to 38.2 t (42 tons) of weapons-grade plutonium already declared by the President as excess to national security needs, the material analyzed includes weapons-grade plutonium that may be declared surplus in the future, as well as weapons-usable, reactor-grade plutonium that is surplus to the programmatic and national defense needs of DOE.

As depicted in Figure S–1, there are seven locations of surplus plutonium within the DOE complex: the Hanford Site (Hanford) near Richland, Washington; Idaho National Engineering and Environmental Laboratory (INEEL) near Idaho Falls, Idaho; Lawrence Livermore National Laboratory (LLNL) in Livermore, California;[7] Los Alamos National Laboratory (LANL) near Los Alamos, New Mexico; the Pantex Plant (Pantex) near Amarillo, Texas; the Rocky Flats Environmental Technology Site (RFETS) near Golden, Colorado; and the Savannah River Site (SRS) near Aiken, South Carolina.

Under the hybrid alternatives, about 34 percent of the surplus plutonium analyzed in the SPD EIS is not suitable for fabrication into MOX fuel due to the complexity, timing, and cost that would be involved in purifying the material. The *Storage and Disposition PEIS* ROD determined that DOE would immobilize at least 8 t (9 tons) of the current surplus plutonium. Since issuance of the ROD, further consideration has indicated that 17 t (19 tons) of the surplus plutonium is not suitable for use in MOX fuel and should be immobilized. Therefore, fabricating all 50 t (55 tons) of surplus plutonium into MOX fuel is not a reasonable alternative and is not analyzed. The SPD EIS does, however, analyze the immobilization of all the surplus plutonium. (Section S.3 of this Summary provides a discussion on the amounts of materials subject to disposition.) Given the variability in purity of the surplus plutonium to be dispositioned, some of the plutonium currently considered for MOX fuel fabrication may also need to be immobilized. The incremental impacts that would be associated with a small shift in materials throughput are discussed in Chapter 4 of the SPD EIS.

In the *Storage and Disposition PEIS* ROD, DOE retained the option to use some of the surplus plutonium as MOX fuel in Canadian Deuterium Uranium (CANDU) reactors, which would have been undertaken only in the event that a multilateral agreement were negotiated among Russia, Canada, and the United States. Since the SPD Draft EIS was issued, DOE determined that adequate reactor capacity is available in the United States to disposition that portion of the U.S. surplus plutonium suitable for MOX fuel and, therefore, while still reserving the CANDU option, DOE is no longer actively pursuing it. DOE, in cooperation with Canada and Russia, proposes to participate in a test and demonstration program using U.S. and Russian MOX fuel in a

[5] Limited activities may be conducted under this contract including non-site-specific work associated with the development of the initial design for the MOX fuel fabrication facility and plans (paper studies) for outreach, long lead-time procurement, regulatory management, facility quality assurance, safeguards, security, fuel qualifications, and deactivation. Under the contract options, no substantive design work or construction on the proposed MOX facility would begin before a SPD EIS ROD is issued, and any such work would depend on decisions in the ROD.

[6] Some materials are already in a final disposition form (i.e., irradiated fuel) and will not require further action before disposal. These materials, therefore, are not included in the 50 t (55 tons) analyzed in the SPD EIS.

[7] Some of the surplus plutonium originally stored at RFETS was shipped to LLNL, where special handling and disassembly processes occurred. The receipt and disassembly of these materials and future processing work will result in the recovery of approximately 1.7 t (1.9 tons) of surplus plutonium at LLNL.

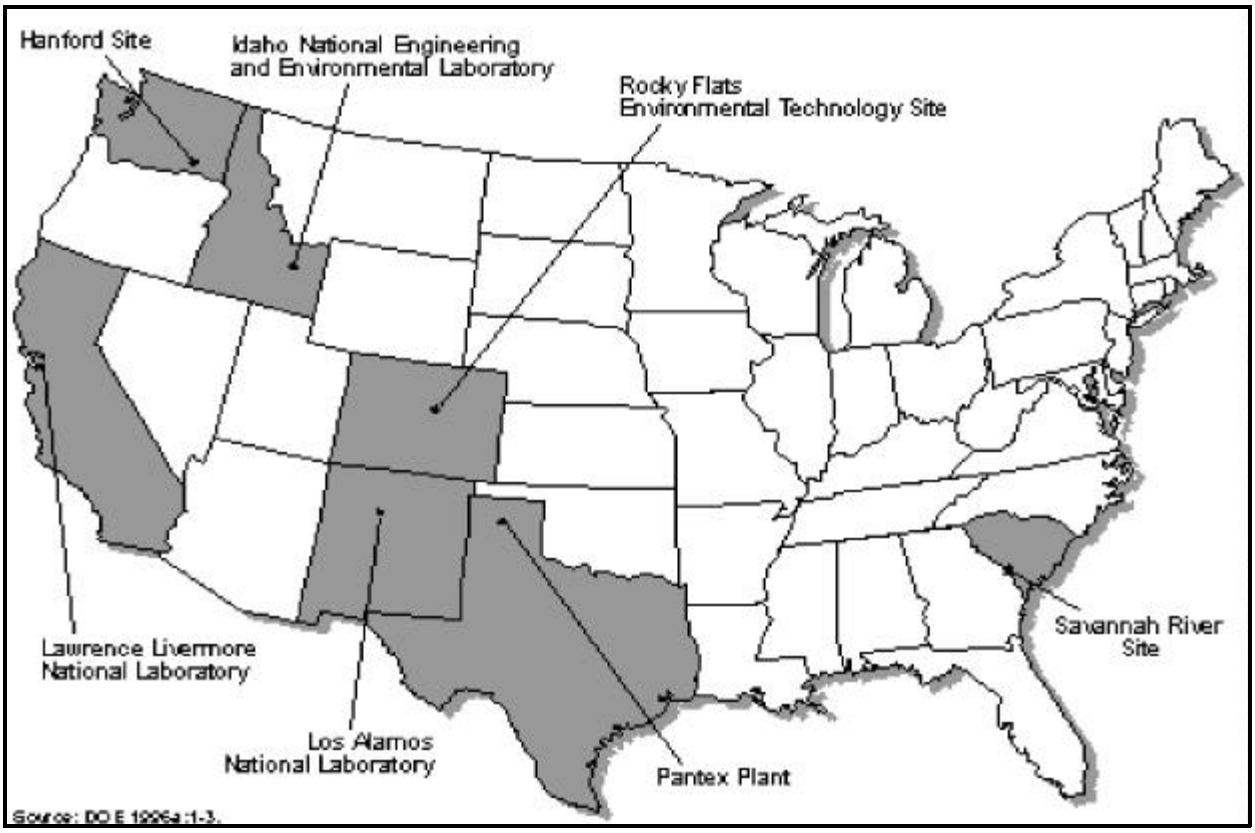


Figure S–1. Locations of Surplus Plutonium

Canadian test reactor.[8] If Russia and Canada agree to disposition Russian surplus plutonium in CANDU reactors in order to augment Russia's disposition capability, shipments of the Russian MOX fuel would take place directly between Russia and Canada.

Purpose of and Need for the Proposed Action

The purpose of and need for the proposed action is to reduce the threat of nuclear weapons proliferation worldwide by conducting disposition of surplus plutonium in the United States in an environmentally safe and timely manner. Comprehensive disposition actions are needed to ensure that surplus plutonium is converted to proliferation-resistant forms. In September 1993, President Clinton issued the *Nonproliferation and Export Control Policy* (White House 1993) in response to the growing threat of nuclear proliferation. Further, in January 1994, President Clinton and Russia's President Yeltsin issued a *Joint Statement Between the United States and Russia on Non-Proliferation of Weapons of Mass Destruction and the Means of Their Delivery* (White House 1994). In accordance with these policies, the focus of the U.S. nonproliferation efforts includes ensuring the safe, secure, long-term storage and disposition of surplus weapons-usable fissile plutonium. Following publication of the SPD Draft EIS, the United States and Russia signed a 5-year agreement to provide the scientific and technical basis for decisions concerning how surplus plutonium will be managed and a statement of principles with the intention of removing approximately 50 t (55 tons) of plutonium from each country's

[8] A separate environmental review, the *Environmental Assessment for the Parallex Project Fuel Manufacture and Shipment* (DOE 1999a; Finding of No Significant Impact [FONSI], August 13, 1999), analyzes the fabrication and proposed shipment of MOX fuel for research and development activities involving the use of limited amounts of U.S. MOX fuel in a Canadian test reactor. The FONSI was announced in a press release on September 2, 1999, and made available to the public.

stockpile (see Appendix A). The disposition activities proposed in the SPD EIS will enhance U.S. credibility and flexibility in negotiations on bilateral and multilateral reductions of surplus weapons-usable fissile materials inventories. [Text deleted.] The United States will retain the option to begin certain disposition activities, whenever appropriate, in order to encourage the Russians and set an international example.

The SPD EIS addresses both the immobilization and MOX approaches to surplus plutonium disposition, which include the siting, construction, operation, and ultimate decontamination and decommissioning (D&D) of three types of facilities at one or two of four candidate DOE sites:

- A facility for disassembling pits (a weapons component) and converting the recovered plutonium, as well as plutonium metal from other sources, into plutonium dioxide suitable for disposition. This facility, the pit disassembly and conversion facility, is referred to in this document as the *pit conversion facility*. Candidate sites for this facility are Hanford, INEEL, Pantex, and SRS.

- A facility for immobilizing surplus plutonium for eventual disposal in a geologic repository pursuant to the Nuclear Waste Policy Act (NWPA), the plutonium conversion and immobilization facility, is referred to as the *immobilization facility*. This facility would include a collocated capability for converting nonpit plutonium materials into plutonium dioxide suitable for immobilization. The immobilization facility would be located at either Hanford or SRS. DOE identified SRS as the preferred site for an immobilization facility in the NOI to prepare the SPD EIS, which was issued in May 1997. Technologies for immobilization are also discussed in the SPD EIS.

- A facility for fabricating plutonium dioxide into MOX fuel, the MOX fuel fabrication facility, is referred to as the *MOX facility*. Candidate sites for this facility are Hanford, INEEL, Pantex, and SRS. Also included in the SPD EIS is a separate analysis of MOX lead assembly[9] activities at five candidate DOE sites: Argonne National Laboratory–West (ANL–W) at INEEL; Hanford; LLNL; LANL; and SRS. DOE would fabricate a limited number of MOX fuel assemblies, referred to as lead assemblies, for testing in a reactor before commencement of fuel irradiation under the proposed MOX fuel program. Postirradiation examination activities at two sites, ANL–W and Oak Ridge National Laboratory (ORNL) in Oak Ridge, Tennessee, are also analyzed in the SPD EIS.

The SPD EIS also analyzes a No Action Alternative, as required by the National Environmental Policy Act (NEPA). In the No Action Alternative, surplus weapons-usable plutonium in storage at various DOE sites would remain at those locations. The vast majority of pits would continue to be stored at Pantex, and the remaining plutonium in various forms would continue to be stored at Hanford, INEEL, LLNL, LANL, RFETS, and SRS.[10]

Issues Identified During the Scoping Period

In mid-1997, DOE conducted a public scoping process to solicit comments on its NOI concerning the disposition of surplus plutonium. The following summary describes the major issues identified during the scoping process.

Issues Already Intended for Inclusion in the SPD EIS. Many comments received during the scoping process concern issues that were already intended to be included in the SPD EIS. For example, many commentors expressed concern over the potential environmental impacts of the various technologies at the candidate sites and requested that an in-depth analysis be conducted to determine the potential impacts. A concern was also

[9] A MOX lead assembly is a prototype reactor fuel assembly that contains MOX fuel.

[10] Should the No Action Alternative be chosen, the ROD pursuant to the SPD EIS would also address the movement of the remaining surplus nonpit plutonium from RFETS in support of its planned closure in 2006.

expressed that making can-in-canister the preferred immobilization technology without an evaluation of alternative technologies circumvents the NEPA process. Other commentors recommended that the SPD EIS include a detailed accounting of the wastes that will be generated and the location of their ultimate disposal. A number of commentors were concerned that existing legal agreements with State governments and other agencies (e.g., triparty agreements) would be overlooked and possibly ignored. Other commentors addressed the quantity of plutonium to be immobilized or fabricated into MOX fuel. DOE is addressing all of these issues in the SPD EIS.

Additional Issues That Need to Be Addressed in the SPD EIS. A few commentors suggested that additional issues be considered in the SPD EIS. [Text deleted.] Some commentors suggested that Pantex be considered as a candidate site for the pit conversion facility under all situations, including the 50-t (55-ton) immobilization option, because most of the surplus pits are currently located there. In response to these comments, DOE added two alternatives to the SPD Draft EIS for the option of immobilizing all 50 t (55 tons) of surplus plutonium. Initially, the alternatives included siting both the pit conversion and immobilization facilities at one site (i.e., Hanford or SRS). The two new alternatives include Pantex as a candidate site for the pit conversion facility.

Issues That Need to Be or Are Already Addressed Elsewhere. Many comments received during the scoping process concern issues that are beyond the scope of the SPD EIS but are being or will be addressed elsewhere. These issues include the relationship of plutonium disposition and tritium production, and use of the Fast Flux Test Facility (FFTF) at Hanford solely for surplus plutonium disposition. The SPD EIS does not address FFTF because the current proposals do not include the use of surplus plutonium as a fuel source for FFTF.[11] A question was raised as to the role of the U.S. Nuclear Regulatory Commission (NRC) licensing requirements in regard to plutonium disposition facilities. Suggestions were made to include NRC processes in the SPD EIS. NRC is a "commenting" agency on the SPD EIS. DOE provided copies of the SPD Draft EIS, *Supplement*, and SPD Final EIS to NRC for review and comment, and DOE is conducting regular meetings with NRC on the MOX approach, including fuel design and qualification.[12] In addition, an NRC license would be sought for the MOX facility. Domestic, commercial reactors operate under NRC licenses, and their proposed use of MOX fuel would be subject to review by NRC.

Some questions and concerns were also raised about the MOX fuel fabrication and reactor irradiation services procurement (see Section S.2 for a discussion of the procurement process and associated NEPA activities). Many commentors suggested that DOE, in either the SPD EIS or other program studies, analyze the total cost of each alternative, including facility construction and modification, operations, and D&D, as well as all related site infrastructure costs. At the same time the SPD Draft EIS was issued, DOE released a cost study (DOE 1998a) focusing on site-specific costs to support site selection. As a followup to this study, DOE prepared a second report (DOE 1999b) that compiles life-cycle costs for the Preferred Alternative and addresses cost-related public comments.[13] These cost studies will be considered, along with the SPD EIS analyses, in the DOE decisionmaking process. Some commentors suggested that the potential impacts of the disposal of spent nuclear fuel generated by MOX fuel use be included in the SPD EIS. This issue has already been addressed in the *Storage and Disposition PEIS*, and disposal of spent nuclear fuel is addressed in the *Draft Environmental Impact Statement*

[11] DOE announced in a Notice of Intent (NOI), published September 15, 1999 (64 FR 50064), that it will prepare a programmatic EIS to evaluate the environmental effects associated with, among other options, the restart and operation of FFTF to meet the need for a range of research and development activities, medical isotope production, and plutonium 238 production to fuel National Aeronautics and Space Administration spacecraft.

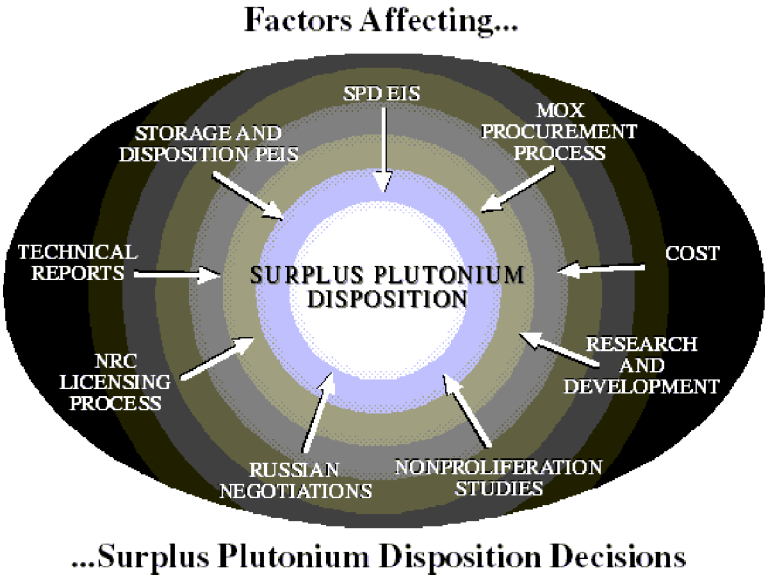
[12] DOE did not receive comments from NRC on the SPD Draft EIS or the *Supplement*.

[13] These two cost reports are available on the Office of Fissile Materials Disposition Web site at http://www.doe-md.com, in the public reading rooms at the candidate sites, and upon request.

for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada (DOE 1999c).[14]

Other. Many of the comments received were expressions of opinion or comments not directly related to issues addressed in the SPD EIS. For example, opposition was expressed by both U.S. and Canadian citizens to using CANDU reactors. Similarly, a number of commentors expressed their support for or opposition to immobilization and MOX technologies. Others expressed support for specific facilities or questioned the viability of site-specific facilities for MOX fuel fabrication, immobilization, or pit conversion. A number of commentors expressed their concern over the market viability of MOX fuel, even though MOX fuel would not be sold on the open market. Some commentors expressed their support for a hybrid disposition approach using both immobilization and MOX fuel fabrication.

Scope of the SPD EIS



Site-specific issues associated with the siting, construction, and operation of the three proposed disposition facilities are analyzed in the SPD EIS. The three facilities would be designed so that they could collectively accomplish disposition of up to 50 t (55 tons) of surplus plutonium over their operating lives, as shown in Table S–1 for the various alternatives under consideration. When the missions of the plutonium disposition facilities are completed, deactivation and stabilization would be performed to reduce the risk of radiological exposure; reduce the need for, and costs associated with, long-term maintenance; and prepare the buildings for potential future use. (Chapter 4 of the SPD EIS provides a discussion on deactivation and stabilization.) At the end of the useful life of the facilities, DOE would evaluate options for D&D or reuse of the facilities. When DOE is ready to propose D&D of these facilities, an appropriate NEPA review will be conducted. (Chapter 4 of the SPD EIS provides a discussion on D&D.) The SPD EIS also analyzes transportation, including the following (see Section S.5 for a more detailed discussion): plutonium from storage locations to the pit conversion facility or the immobilization facility, depending on the material and the alternative; plutonium dioxide from the pit conversion facility to the immobilization or MOX facilities; recovered HEU from the pit conversion facility to Oak Ridge Reservation (ORR); depleted uranium hexafluoride from a representative DOE site to a representative commercial conversion facility; uranium feed

[14] For purposes of the SPD EIS, a potential geologic repository candidate site at Yucca Mountain, Nevada, was assumed to be the final disposal site for all immobilized plutonium and spent fuel. Currently, Yucca Mountain is the only site being characterized as a potential geologic repository. In August 1999, DOE issued a separate EIS, the *Draft Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE/EIS-0250D) (DOE 1999c), to analyze the site-specific environmental impacts of construction, operation and monitoring, and eventual closure of a potential geologic repository at Yucca Mountain.

Table S–1. Surplus Plutonium Disposition Facility Alternatives Evaluated in the SPD EIS

Alternative	Pit Disassembly and Conversion	Plutonium Conversion and Immobilization	MOX Fuel Fabrication	Disposition Amounts (Plutonium)
1	**No Action**			
2	Hanford (FMEF)	Hanford (FMEF and HLWVF)	Hanford (New)	17 t Immobilization/ 33 t MOX
3	SRS (New)	SRS (New and DWPF)	SRS (New)	17 t Immobilization/ 33 t MOX
4A	Pantex (New)	Hanford (FMEF and HLWVF)	Hanford (New)	17 t Immobilization/ 33 t MOX
4B	Pantex (New)	Hanford (FMEF and HLWVF)	Hanford (FMEF)	17 t Immobilization/ 33 t MOX
5	Pantex (New)	SRS (New and DWPF)	SRS (New)	17 t Immobilization/ 33 t MOX
6A	Hanford (FMEF)	SRS (New and DWPF)	Hanford (New)	17 t Immobilization/ 33 t MOX
6B	Hanford (FMEF)	SRS (New and DWPF)	Hanford (FMEF)	17 t Immobilization/ 33 t MOX
7	INEEL (FPF)	SRS (New and DWPF)	INEEL (New)	17 t Immobilization/ 33 t MOX
8	INEEL (FPF)	Hanford (FMEF and HLWVF)	INEEL (New)	17 t Immobilization/ 33 t MOX
9	Pantex (New)	SRS (New and DWPF)	Pantex (New)	17 t Immobilization/ 33 t MOX
10	Pantex (New)	Hanford (FMEF and HLWVF)	Pantex (New)	17 t Immobilization/ 33 t MOX
11A	Hanford (FMEF)	Hanford (FMEF and HLWVF)	NA	50 t Immobilization/ 0 t MOX
11B	Pantex (New)	Hanford (FMEF and HLWVF)	NA	50 t Immobilization/ 0 t MOX
12A	SRS (New)	SRS (New and DWPF)	NA	50 t Immobilization/ 0 t MOX
12B	Pantex (New)	SRS (New and DWPF)	NA	50 t Immobilization/ 0 t MOX
[Text deleted.] Alternatives 3B, 5B, 6C, 6D, 7B, 9B, 12B, and 12D have been deleted. Alternative 12C has been renumbered as 12B.[a]				

[a] Section S–4 explains the deletion of these alternatives.

Key: DWPF, Defense Waste Processing Facility; FMEF, Fuels and Materials Examination Facility; FPF, Fuel Processing Facility; HLWVF, high-level-waste vitrification facility (planned); NA, not applicable.

supply (uranium dioxide) from a representative commercial conversion facility to the immobilization and/or MOX fuel fabrication facilities and lead assembly facility; uranium fuel rods from a commercial fuel fabrication facility to the MOX facility and lead assembly facility; plutonium dioxide from LANL to the lead assembly facility; irradiated lead assemblies or rods from a reactor to the postirradiation examination site; spent fuel from the postirradiation examination site to INEEL for storage; MOX fuel to a commercial reactor; and immobilized plutonium to a potential geologic repository.[15] In addition to the various disposition alternatives, a No Action

[15] Shipments of spent fuel to a potential geologic repository are analyzed in the *Draft Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE/EIS-0250D) (DOE 1999c).

Alternative is also analyzed. In this alternative, disposition would not occur, and surplus plutonium would remain in long-term storage in accordance with the storage approach identified in the *Storage and Disposition PEIS* ROD.[16] For all alternatives analyzed in the SPD EIS, it is assumed that storage actions described in the *Storage and Disposition PEIS* ROD, as amended, have been accomplished.[17] Because the SPD EIS tiers from the analyses and decisions reached in association with the *Storage and Disposition PEIS*, information relevant to disposition options or candidate sites is incorporated by reference and summarized; it is not repeated here. [Text deleted.]

Lead Assembly Candidate Sites

ANL–W
Hanford
LLNL
LANL
SRS

As part of the assessment of the MOX alternatives, the SPD EIS analyzes the fabrication of up to 10 lead assemblies that may be needed to support the MOX fuel program, although DOE plans to produce only 2. (See Sections 2.18.2 and 4.27 of the SPD EIS for a discussion of how impacts would be lower if only two lead assemblies were fabricated.) Existing DOE facilities at five candidate sites are analyzed, as is the transportation of feed materials to the lead assembly fabrication sites and the fabricated lead assemblies to a domestic, commercial reactor for test irradiation. Postirradiation examination may be required to support NRC licensing activities related to the use of MOX fuel in domestic, commercial reactors. The SPD EIS discusses postirradiation examination at two candidate sites, ANL–W and ORNL. These two sites are currently the only sites that possess the capability to conduct postirradiation examination activities without major modifications to facility and processing capabilities; only minor modifications for receipt of materials would be required. Other potential facilities, either within the DOE complex or in the commercial sector, would require significant modifications to meet expected requirements for postirradiation examination.

The ceramic immobilization, MOX fuel fabrication, and lead assembly processes require the use of uranium dioxide as a feed material, which can be obtained from either natural or depleted uranium. Because DOE has a large inventory of depleted uranium hexafluoride (the equivalent of 385,000 t [424,385 tons] of depleted uranium dioxide), the SPD EIS analyzes using a small amount of that inventory (about 137 t [151 tons] per year) to produce uranium dioxide (White 1997:l).[18, 19] Depleted uranium hexafluoride is currently stored at three DOE sites: the East Tennessee Technology Park in Oak Ridge, Tennessee; the Paducah Gaseous Diffusion Plant near Paducah, Kentucky; and the Portsmouth Gaseous Diffusion Plant (Portsmouth) near Piketon, Ohio. For purposes of analysis in the SPD EIS, Portsmouth is used as a representative site for a source of depleted uranium hexafluoride.[20] Included for evaluation in the SPD EIS are the activities necessary to package the depleted

[16] Should the No Action Alternative be chosen, the ROD pursuant to the SPD EIS would also address the movement of the remaining surplus nonpit plutonium from RFETS in support of its planned closure in 2006.

[17] Recent studies indicated that cost savings could be realized from the transfer of nonpit materials from RFETS and Hanford to SRS earlier than specified in the *Storage and Disposition PEIS* ROD. A supplement analysis was prepared and determined that a supplemental PEIS would not be needed; an amended ROD was issued in August 1998 (63 FR43386) and included decisions to accelerate shipment of all nonpit surplus plutonium from RFETS to SRS and the relocation of all Hanford surplus plutonium to SRS, if SRS is selected as the immobilization disposition site.

[18] The contractor chosen by DOE to conduct MOX fuel fabrication has the option of acquiring uranium dioxide from another source.

[19] Potential use of depleted uranium hexafluoride or facilities at the gaseous diffusion plants will be consistent with the *Final Programmatic Environmental Impact Statement for Alternative Strategies for the Long-Term Management and Use of Depleted Uranium Hexafluoride* (DOE/EIS-0269, April 1999; ROD August 1999) and the *Final Plan for Conversion of Depleted Uranium Hexafluoride, As Required by Public Law 105–204* (DOE, July 1999).

[20] The Portsmouth Gaseous Diffusion Plant is used as a representative site because it is the only one of the three DOE sites that is currently capable of transferring the depleted uranium hexafluoride from the 12.7-t (14-ton) tails cylinders in which it is currently stored to the 2.28-t (2.5-ton) feed cylinders that are compatible with the processing equipment at a commercial facility (White 1997:5). However, DOE has no preference as to where the depleted uranium is acquired.

uranium hexafluoride for shipment to a representative commercial conversion facility (for purposes of analysis, the SPD EIS uses the General Electric Company's Nuclear Energy Production Facility in Wilmington, North Carolina) for conversion to uranium dioxide,[21] to transport the depleted uranium hexafluoride from Portsmouth to Wilmington, and to transport the uranium dioxide from Wilmington to the candidate immobilization, MOX fuel fabrication, and lead assembly sites (i.e., ANL–W, Hanford, INEEL, LLNL, LANL, Pantex, and SRS).

DOE's NOI announcing the preparation of the SPD EIS included a table outlining 12 originally proposed disposition alternatives. Each alternative identified the facilities, new or existing, at each candidate site that would be analyzed in the SPD EIS. Since the publication of the NOI, DOE further increased the number of alternatives for SPD EIS analysis to include a new MOX facility at Hanford, in addition to the alternative involving modifying the Fuels and Materials Examination Facility (FMEF). For the option of immobilizing all 50 t (55 tons) of surplus plutonium, DOE also included Pantex as a candidate site for pit disassembly and conversion activities, making a total of four 50-t (55-ton) all-immobilization alternatives in the SPD Draft EIS. Previously, only Hanford and SRS had been considered as sites for pit disassembly and conversion activities for the 50-t (55-ton) all-immobilization case. Eight alternatives using Building 221–F at SRS for the immobilization facility that were analyzed in the SPD Draft EIS have been eliminated from the SPD Final EIS because the amount of space required for the immobilization facility would be significantly larger than originally planned. These eight alternatives are no longer considered reasonable because the construction required for the proposed immobilization facility is now expected to be nearly the same whether the facility is entirely located in a new building or is built in addition to using a portion of Building 221–F at SRS. For clarity, variations of each alternative are presented in the SPD EIS as separate, discrete alternatives. There are now 15 action alternatives presented as 11 sets of alternatives, plus the No Action Alternative (see Table S–1).

As indicated in the ROD for the *Storage and Disposition PEIS*, the SPD EIS analysis provides, in part, the basis for determining a specific immobilization technology. The SPD EIS analyzes in detail the proposed can-in-canister approach and compares the results to the impacts predicted in the *Storage and Disposition PEIS* for the homogenous immobilization approach in new vitrification and ceramic immobilization facilities. In addition, for the can-in-canister approach, the SPD EIS separately analyzes the effects of immobilizing plutonium in either a titanate-based ceramic material or a lanthanide borosilicate glass.

To further define the potential processes to be used for the disposition of surplus plutonium, several research and development (R&D) activities are ongoing. A discussion of these R&D activities is provided in the *Pit Disassembly and Conversion Demonstration Environmental Assessment and Research and Development Activities* (DOE 1998b) (DOE/EA-1207, August 1998; Finding of No Significant Impact [FONSI], August 1998). Several of these R&D activities are likely to continue after the ROD for the SPD EIS is issued.

Preferred Alternatives

DOE's Preferred Alternative for the disposition of surplus weapons-usable plutonium is Alternative 3: to disposition up to 50 t[22] (55 tons) of plutonium at SRS using a hybrid approach that involves both the ceramic can-in-canister immobilization approach and the MOX approach. Approximately 17 t (19 tons) would be immobilized in a ceramic form, placed in cans, and embedded in large canisters containing high-level vitrified waste for ultimate disposal in a potential geologic repository pursuant to the NWPA. Approximately 33 t

[21] Possible existing sites for this conversion include nuclear fuel fabrication facilities in Missouri, North Carolina, South Carolina, and Washington, or a uranium conversion facility in Illinois. For purposes of analysis in the SPD EIS, the commercial nuclear fuel fabrication facility in Wilmington, North Carolina, was used as a representative site. DOE has no preference as to where conversion would occur.

[22] Some materials are already in a final disposition form (i.e., irradiated fuel) and will not require further action before disposal. These materials are not included in the SPD EIS.

(36 tons) would be used to fabricate MOX fuel, which would be irradiated in existing, domestic, commercial reactors. The proposed reactors are the Catawba Nuclear Station near York, South Carolina; the McGuire Nuclear Station near Huntersville, North Carolina; and the North Anna Power Station near Mineral, Virginia.[23] The resulting spent fuel would be placed in a potential geologic repository pursuant to the NWPA.

Pursuing the hybrid approach provides the best opportunity for U.S. leadership in working with Russia to implement similar options for reducing Russia's excess plutonium in parallel. Further, it sends the strongest possible signal to the world of U.S. determination to reduce stockpiles of surplus weapons-usable plutonium as quickly as possible and in a manner that would make it technically difficult to use the plutonium in weapons again. Pursuing both immobilization and MOX fuel fabrication also provides important insurance against uncertainties of implementing either approach by itself. The construction of new facilities for the disposition of surplus U.S. plutonium would not take place unless there were significant progress on plans for plutonium disposition in Russia.

DOE's preference for siting plutonium disposition facilities is as follows:

- **Pit Disassembly and Conversion at SRS.** Construct and operate a new pit conversion facility at SRS for the purpose of disassembling nuclear weapons pits and converting the plutonium metal to a declassified oxide form suitable for international inspection, and disposition using either immobilization or MOX/reactor approaches. SRS is preferred for the pit conversion facility because the site has extensive experience with plutonium processing, and the pit conversion facility complements existing missions and takes advantage of existing infrastructure. [Text deleted.]

- **Immobilization at SRS (new construction and Defense Waste Processing Facility).**[24] Construct and operate a new immobilization facility at SRS using the ceramic can-in-canister technology. This technology would immobilize plutonium in a ceramic form, seal it in cans, and place the cans in canisters filled with borosilicate glass containing radioactive high-level waste (HLW) at the existing Defense Waste Processing Facility (DWPF). This preferred can-in-canister approach at SRS complements existing missions, takes advantage of existing infrastructure and staff expertise, and enables DOE to use an existing facility (DWPF). SRS was previously designated to be part of DOE's Preferred Alternative for immobilization in the NOI issued in May 1997. The ceramic can-in-canister approach would involve slightly lower environmental impacts than the homogenous approach (wherein the plutonium is incorporated into a homogenous mixture of plutonium and fission products in a single waste form). The ceramic can-in-canister approach would involve better performance in a potential geologic repository due to the ceramic form's expected higher durability under repository conditions and its lower potential for long-term criticality. In addition, it would provide greater proliferation resistance than the glass can-in-canister approach because recovery of plutonium from the ceramic form would require a more chemically complex process than has yet been developed.

- **MOX Fuel Fabrication at SRS (new construction).** Construct and operate a new MOX facility at SRS and produce MOX fuel containing surplus weapons-usable plutonium for irradiation in existing

[23] No facility construction or MOX fuel fabrication or irradiation is to occur until the SPD EIS ROD is issued. Additionally, no MOX fuel is to be irradiated until the NRC amends the operating license of each selected reactor prior to the specific reactor receiving the MOX fuel. Such site-specific activities would depend on decisions in the ROD, and DOE's exercise of contract options to allow such activities would be contingent on the ROD.

[24] DOE is presently considering replacement alternatives for the In-Tank Precipitation (ITP) process at SRS. The ITP process was intended to separate soluble high-activity radionuclides from liquid HLW before vitrifying the high-level fraction in DWPF. Due to problems experienced with the operation of ITP as configured, DWPF is currently operating with sludge feed only. A supplemental EIS on DWPF operations is being prepared that analyzes three proposed alternatives: small tank precipitation, ion exchange, and direct grout. (Section 2.4.2.1 of the SPD EIS provides a more detailed discussion of these alternatives.)

domestic, commercial reactors. SRS is preferred for the MOX facility because this activity complements existing missions and takes advantage of existing support infrastructure and staff expertise. [Text deleted].

- **Lead Assembly Fabrication at LANL.** Based on consideration of the capabilities of the candidate sites and input from the contractor team chosen for the MOX approach, DOE prefers LANL for lead assembly fabrication. LANL is preferred because it already has fuel fabrication facilities that would not require major modifications, and takes advantage of existing infrastructure and staff experience. Additionally, the surplus plutonium dioxide that would be used to fabricate the lead assemblieswould already be in inventory at the site.

- **Postirradiation Examination at ORNL.** If postirradiation examination is necessary for the purpose of qualifying the MOX fuel for commercial reactor use, DOE prefers to perform that task at ORNL. ORNL has the existing facilities and staff expertise needed to perform postirradiation examination as a matter of its routine activities; no major modifications to facilities or processing capabilities would be required. In addition, because ORNL is about 500 km (300 mi) from the McGuire Nuclear Station, the reactor that would irradiate the fuel, it is the closest candidate site for postirradiation examination activities.

S.2 SUMMARY OF MAJOR ISSUES IDENTIFIED DURING THE COMMENT PERIODS AND CHANGES TO THE SPD DRAFT EIS

Public Involvement Process for the SPD Draft EIS and the *Supplement to the SPD Draft EIS*

DOE issued the SPD Draft EIS in July 1998 and received public comments. The comment period ran from July 17, 1998, through September 16, 1998, although DOE considered all comments submitted after the close of the 60-day comment period. In August 1998, DOE held five public hearings at the following locations in the vicinity of the four candidate DOE sites and at one regional location:

Richland, Washington	August 4, 1998
Amarillo, Texas	August 11, 1998
North Augusta, South Carolina	August 13, 1998
Portland, Oregon	August 18, 1998
Idaho Falls, Idaho	August 20, 1998

DOE received comments on the SPD Draft EIS by mail, a toll-free telephone and fax line, the Office of Fissile Materials Disposition Web site, and at the public hearings. Altogether, DOE received approximately 3,400 comment documents from individuals and organizations. All comments are presented in Volume III, Parts A and B, of the Comment Response Document of the SPD Final EIS. Approximately 65 percent of the comments received consisted of mail-in postcard campaigns that expressed either support of or opposition to the use of various sites or technologies. About 12 percent were collected during public hearings, 10 percent were in letters received by mail, 10 percent were received by fax, 2 percent were received by telephone, and 1 percent were received through the Web site.

In April 1999, DOE issued the *Supplement* and received public comments. The comment period ran from May 14, 1999, through June 28, 1999, although DOE considered all comments received after the close of the 45-day comment period. On June 15, 1999, DOE held a public hearing in Washington, D.C. DOE received approximately 77 comment documents from individuals and organizations, which are presented in Volume III, Part B, of the Comment Response Document of the SPD Final EIS. Approximately 21 percent of the comments received were collected during the public hearing, 34 percent were contained in letters received by mail,